Calibration of EUV-2D Photoresist Simulation Parameters for Accurate Predictive Modeling

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The extremely limited availability of EUV exposure tools necessitates the use of lithographic simulation to explore the practicality and manufacturability of future EUV lithography options. Although aerial image simulations can be made with great accuracy, current resist models do not, typically, predict an accurate response through either pitch or feature size. The observed lack of accuracy stems from the large number of degrees of freedom in the resist model (30+) and the restricted dataset available for model calibration.[1]

In this work, a model for Shipley EUV-2D Photoresist is derived from an extended experimental dataset, in order to maximize the fit quality. The dataset includes full Focus-Exposure Matrix CD data for 70, 80, 90 and 100-nm lines in multiple pitches, and cross-sectional profile information. The exposures were conducted at a static exposure station installed at the Advanced Light Source synchrotron radiation facility at Lawrence Berkeley National Laboratory. The optic used was the 0.1-NA 4×-reduction ETS Set-2 optic and the illumination parameters designed to match typical lithographic conditions.

The initial modeling parameters are derived from experiment and theory. These values are then refined using of an automated fitting program,[2] which minimizes the error between simulated results and the experimental data. In order to maximize the accuracy of the resist modeling parameters, the fit takes into account actual mask dimensions, characterized aberrations in the optics and CD metrology artifacts.

1. R. L. Brainard, D. O'Connell, J. Mackevich, S. Gunn, P. Dentinger, J. Cobb, "Resist Development for EUV Lithography", 3rd International Workshop on EUV Lithography, October 2001.
2. J.D. Byers, C.A. Mack, R. Huang and S. Jug, "Automatic calibration of lithography simulation parameters using multiple data sets", MNE 2001, Paper PH7, 2001.